HOW THE MACHINING CELL MAKES FLEXIBILITY GO

WILLIAM DRAPER, CHAIRMAN EXPORT-IMPORT BANK, TALKS ABOUT PROTECTIONISM

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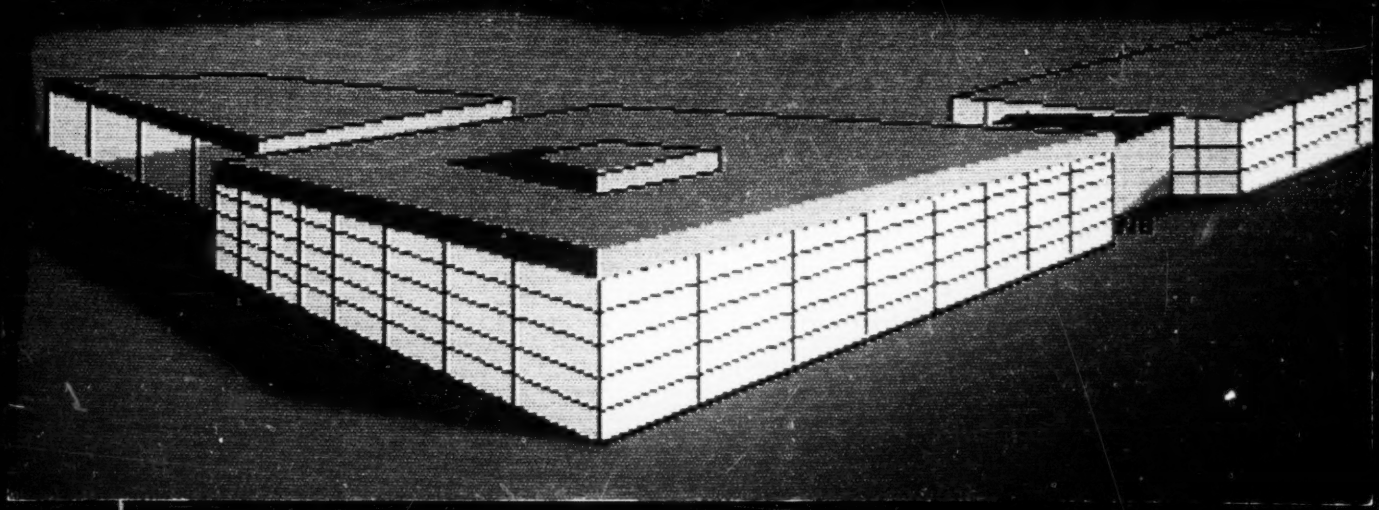
FACTORY OF THE FUTURE

THE LOVE/HATE RESPONSE TO AUTOMATION



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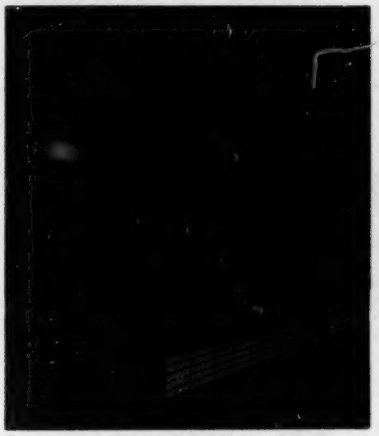

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HARD TIMES COME TO THE OIL PATCH

Both the major oil companies and the independents are cutting their spending on exploration and production this year.

BY SUSAN T. PARKER

A year ago the majority of U.S. oil companies—buoyed by the frenetic drilling pace of 1981—announced ambitious domestic exploration and production (E&P) budgets for 1982. They had good reason to believe that 1982 would be as good, if not better, than 1981.

But they were wrong—dead wrong. As the year wore on, oil prices softened, a natural gas 'bubble' took hold, and the weekly drilling rig count continued its precipitous slide. A general 'gloom and doom' attitude enveloped the entire energy industry; this contrasted sharply with the 'boom' attitude of 1981. As a result, many of the ambitious E&P budgets of major and independent oil companies fell by the wayside.

Companies that initially had planned to spend several billion dollars on domestic exploration and production in 1982 wound up having to scale back their budgets considerably. Needless to say, this severely impacted the profit pictures for producers and distributors of oil country tubular goods (OCTG) and oilfield equipment.

Now, oil companies are once again faced with the necessary, but highly-speculative task of ironing out their E&P budgets for 1983. Understandably, they are still smarting from last year and, as a result, are cautious and conservative about their budget forecasts. Some of the larger oil companies are refusing altogether to publicly announce their 1983 E&P budgets for fear that they might have to eat their words later on if U.S. drilling activity worsens. They had to do this in 1982 and so they are trying to avoid a repeat performance this year.

This cautious stance is, in fact, a sign of the times. Said one industry observer, "When times are great, they (the oil companies) disclose everything. But now they are playing it close to the vest and are not making any budget commitments." An industry analyst agreed, noting that he surveyed major oil companies about their 1983 E&P budgets, but only received "vague" and "cautious" responses. "They are not giving specific (budget) numbers," he added.

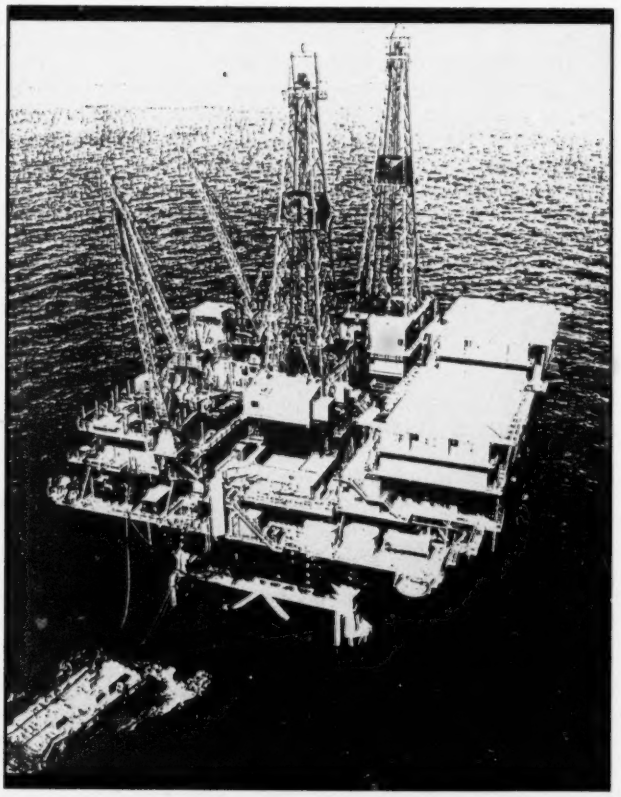
To say the least, this does not bode well for those firms that supply services and equipment to the oil industry. They find themselves two months into the new year with no clear-cut picture of oil company spending plans. At best, they are having to hazard guesses.

One survey that several energy sup-

U.S. Oil Exploration Expenditures 1983 vs '82
Major Oil Companies, In Millions of Dollars

	1983 Est*	1982 Est	Pct Chg.
Amerada Hess	430	390	10
Atlantic Richfield	3,150	3,000	5
Du Pont (Conoco)	775	775	—
Getty	1,400	1,300	15
Gulf	1,450	1,550	−6
Mobil	1,775	1,900	−7
Occidental	475	695	−32
Pennzoil	365	380	−4
Phillips	650	625	4
R.J. Reynolds	445	410	8
Shell	2,600	2,600	—
Sohio	2,000	2,000	—
Standard of Calif.	1,950	1,900	3
Standard of Indiana	2,200	2,200	—
Sun	750	950	−21
Superior	925	975	−5
Tenneco	1,200	1,250	−4
Texaco	1,800	1,600	13
Texas Oil & Gas	470	435	8
Union Oil	900	900	—
Union Pacific	500	450	11
U.S. Steel (Marathon)	500	500	—
Total	**26,710**	**26,785**	**−0.3**

*Estimates by E. Salomon Brothers



pliers seem to be relying on was conducted by James Crandell, vice president, New York-based Salomon Bros. Inc. It contains both good and bad news. "The good news is that most major oil companies, who represent more than 50 pct of total industry spending, intend to at least maintain their 1982 level of E&P expenditures in 1983," the survey says.

Mr. Crandell surveyed 22 major oil and gas companies and found that 1983 E&P expenditures on the average will be about 3 pct, or $75 million, lower than last year (see chart).

Now for the bad news. Independent oil and gas companies, who drill 85 pct of all wells, have cut their E&P spending plans sharply for 1983, reports Mr. Crandell. "Of the 64 independents we surveyed, expected E&P spending for 1983 declined 23 pct, on average, from 1982," the report notes. Mr. Crandell estimates that E&P spending by independents this year will average $5.4 billion compared to $7 billion in 1982.

"While these spending plans (by majors and independents) are certainly not set in stone, it is important to note that oil companies decided on their budgets in an environment of weakening oil prices, poor refining/marketing earnings and declining natural gas sales and are using very conservative economic assumptions in their forecasts," the survey says.

Some of the major conclusions reached by Salomon Bros. in its survey include:

—The difference between major (−3 pct) and independent (−23 pct) company spending plans in 1983 is highly significant. Of the 64 independents surveyed, 41 anticipated lower E&P spending in 1983 while only seven of the 22 majors surveyed expected lower E&P spending this year.

—Nominal drilling expenditures will decline by about 8-10 pct this year. "With drilling costs expected to drop another 5-8 pct, we believe that real levels of drilling activity in 1983 could be close to those of 1982," the survey says.

—Most of the cuts in independent oil and gas company drilling budgets are coming from the natural gas segment. Due to reductions in gas purchases by the pipelines, many substantial independent gas producers are producing natural gas at only about 50 pct of effective capacity.

—Almost every independent oil and gas company surveyed is moving away from deep gas drilling because of lower deep gas prices, a reduction in gas sales, the difficulty in hooking up wells, overpressurized zones, and the feeling that the technology is not adequate. These problems are particularly acute in Oklahoma's Anadarko Basin.

—Most independents and many majors are emphasizing drilling on oil prospects. The elimination of the windfall profit tax on stripper oil for certain independents (as defined by the Federal Windfall Profits Tax Act) should result in a substantial improvement in realizations to these companies and a sizeable pickup in this type of drilling.

—Because of cash flow considerations, most companies are emphasizing development drilling over exploratory drilling.

—Spending on offshore leases by the majors should remain substantial in 1983 due to the large amount of prospective acreage that will become available in Alaska and the Gulf of Mexico this year.

For the most part, executives of energy and energy-related firms agree with the results of the Salomon Bros. survey. "We expect the majors' E&P budgets to be relatively flat in 1983 and the independents to be lower. How much lower I can't say; I don't think anybody knows at this point," says Ike C. Kerridge, vice president of stockholder relations, Houston-based Hughes Tool Co., a major producer of oilfield equipment.

Many of the larger oil companies have yet to announce their 1983 E&P budgets.

Overall, Mr. Kerridge expects "slightly lower" drilling activity in the U.S. this year. He estimates that the weekly domestic rig count in 1983 will average 2,675 rigs compared to 3,105 rigs last year. Moreover, he expects the amount of footage drilled this year to drop 9 pct to 312 million ft.

Mr. Kerridge also believes that the pattern of drilling activity in 1983 will be the reverse of last year. "We think drilling will be down (by about 350 rigs) in the first quarter and up the last three quarters," he said. Last year, drilling activity fell the first three quarters and finally rose in the last quarter.

Separately, Tenneco Oil Co. reports that its E&P budget, though still not approved, will be "roughly the same" as 1982. "The mix is going to be different," a company official says, explaining that more capital will be put into exploration and less into production wells.

"We don't need to produce. Why produce the stuff (oil and gas) when you can't sell it. What we are hoping to do is build up our reserves for when the market does pick up," the Tenneco official explains. He further notes that Tenneco will most likely be concentrating on shallower prospects in 1983.

Despite its flat 1983 E&P budget, Tenneco sees a good year ahead. "I don't think the year is going to be as bad as some people believe it will be," the Tenneco official notes. "Normally a flat capital budget would mean you would drill less wells, but that's not necessarily the case this year. Drilling costs have declined considerably in many areas (and) a lot of services have dropped in prices. Because of this, I believe about the same number of wells will be drilled in 1983 that were drilled last year."

Similarly, Pittsburgh-based Gulf Oil Corp. reports that its E&P budget this year will either be "slightly less" or "on the same magnitude" of its 1982 E&P budget. Its capital spending plans, the company says, still have yet to be approved.

Adobe Oil & Gas Corp., an independent oil and gas firm based in Midland, Texas, says that it also intends to maintain about the same level of drilling activity in 1983. Its E&P budget is expected to be in the range of $50 million, according to Curtis S. Bedrich, vice president, finance.

Mr. Bedrich says the company's plans call for both oil and gas drilling in 1983. He added, however, "We would tend towards oil (exploration) if we have to make a choice." He also says that Adobe will probably be emphasizing developmental drilling this year more than wildcat drilling.

Shell Oil Co., Houston, reports that its overall capital expenditure budget for 1983 will be $3 billion. Approximately $660 million of this will be earmarked for exploration, a Shell spokesman says. This is $30 million more than was spent in 1982.

Houston-based Superior Oil Co. plans capital and exploration spending of $1.2 billion in 1983, down from $1.3 billion a year ago. Of this amount, Superior says it expects to spend about $780 million for exploration and production activities in the U.S. This is considerably lower than the $925 million that the Salomon Bros. estimated Superior would spend in 1983.

Many of the larger integrated oil companies, most notably Exxon Corp., have yet to announce their 1983 E&P budgets, and probably will not do so for another month. They are closely tracking first quarter drilling activity before committing themselves. Says one industry insider, "A lot depends on the first quarter." ❑

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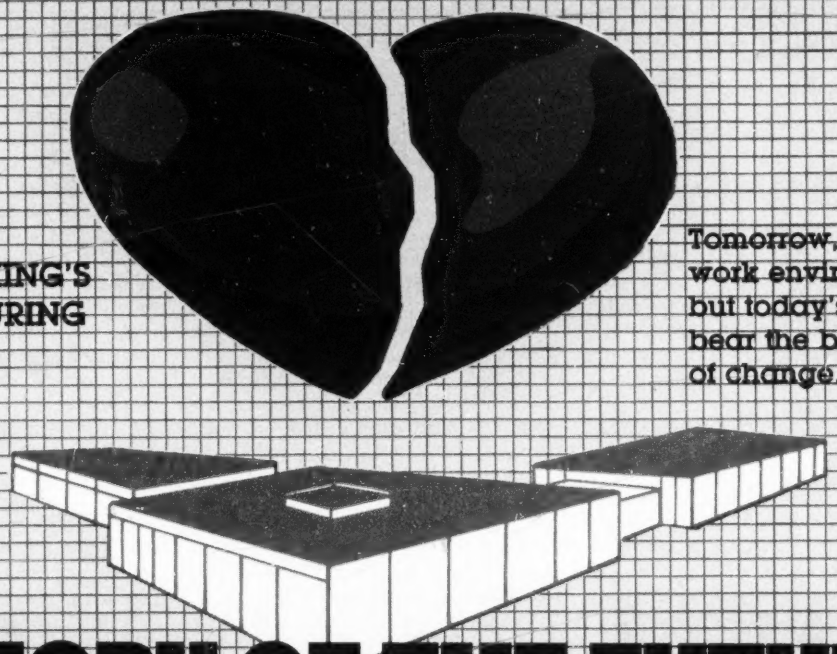
METALWORKING'S MANUFACTURING SYSTEMS

Tomorrow, a better work environment, but today's workers bear the burden of change.



FACTORY OF THE FUTURE: THE LOVE/HATE RESPONSE TO AUTOMATION

BY ALICE M. GREENE

Workers in a faceless environment, devoid of human interchange, taking orders from talking machines and CRT screens with a elite corps of technologists in white coats running these machines from a remote and sterile computer room—could this be the factory of the future?

Hardly a phrase has been as widely used as "factory of the future" and with as much ambiguity. The promises and pitfalls of this concept are touted and decried daily.

Truth is, definitions of the factory of the future vary widely. And many opinions expressed are prompted by fear, ignorance or both.

A definition often attributed to blue collar workers is that the factory of the future is one in which machines are doing work that previously was done by semi-skilled or unskilled humans. Those people think of the future factory as being populated by computer-controlled assembly, welding and inspection robots—all of which replace people, says Richard N. Spann, president of Adage, Inc., a Boston-area firm, whose computer graphics systems usher computer-aided design into the forward-looking factory.

Managers, designers, engineers, on the other hand, may have a completely different concept. Their concept of the factory of the future is one that is computer-driven, not human-driven.

This point of view sees computers enhancing human thought processes and expanding an individual's potential in a more creative work environment.

"These conflicting views reflect a lack, not so much of understanding because it is clear that both things will happen,

but rather an ambiguity of how they are going to happen, and in what time sequence," comments Mr. Spann.

There is activity in both areas at the present time. Quite a few robots already work in our factories, although today's robots are relatively simple in function and in control compared to what lies ahead.

At the other end of the spectrum, computer-aided design and computer-aided engineering are evidence of thought processes that are being computer assisted.

Between these extremes, there exists a huge gap. Advanced manufacturing concepts such as group technology and process planning need to be implemented. Automated material handling techniques need to be incorporated into the production flow.

Actually, much more effort is needed in making the production cycle a more continuous process from design through manufacturing.

All these technologies need to be managed with planning, scheduling and control systems. And the coordination of all these technologies must be accomplished with communications systems and data management systems. When all these ingredients are integrated, the factory of the future will exist. This isn't going to happen overnight.

In a sense, present day reactions to the factory of the future are like feeling the pain of the dentist's drill before you even get to the office, in some cases, before you even make an appointment. It may not be as traumatic as you think.

Such 'advance reactions' are human. So is the fear of change. And, so is the excitement created by a new technology. The fascination with and popularity of science fiction books and films over the years is evidence that many people find 'futuristic' developments intriguing, even if a bit intimidating.

Positive and negative reactions exist in the public's mind about the future factory.

A public opinion report, recently conducted by Opinion Research Corp. (ORC), Princeton, N.J., reveals that Americans anticipate several positive benefits for productivity and the U.S. economy if automation is increased.

"The vast majority of the public think that American-made products would be more competitive in world markets, perhaps due, in part, to the widespread feeling that the quality of U.S. goods would improve," says Kenneth Schwartz, vice president, ORC. "The majority of people think U.S. products would be more competitive in world markets.

"At least seven people in ten in almost every segment of the population look for a significant increase in economic growth and productivity in the country. A majority of people in almost all subgroups expect living standards to improve," adds Mr. Schwartz.

An improved economy and standard of living—very positive expectations existing in the midst of fear of losing jobs to automation, near despair about the possibility of retraining for new skills.

What seems clear is that ultimately, the factory of the future will use fewer people. Figures issued by the Bureau of Labor Statistics on the distribution of employed workers shows a decrease in the industry segment from 30 pct of the work force in 1960 to 25 pct in 1985. And this shift will continue. The declining birth rate, the shift of jobs into the service sector, and the unpleasantness of many factory jobs are some of the reasons for this shift, in addition to the drive to automation.

There will be a need for higher skill levels. Skilled machinists, computer programmers and operators, maintenance electricians will be in short supply. Knowledge workers, engineers, designers, scientists, systems people will find jobs aplenty.

At the lower levels, some jobs will be upgraded as workers learn to use computer assists. Many will find jobs more interesting, more challenging, because through computer assistance, they can know more about how their jobs relate to the broader factory environment.

"A lot of assembly line workers have been bored into ulcers by the drudgery and monotony of the work," says Robert B. Vollum C.P.I.M., senior manufacturing consultant, Sperry Univac.

The picture is not rosy, however. There will be massive displacements. Entire industries will change in size and importance, and the workers from those industries will have to undergo retraining and/or relocation to find jobs. Geographic areas will be hard hit.

Even those who have jobs will face a major readjustment—that includes managers as well as shop floor personnel.

The shock of automation, the impact of the factory of the future will come gradually to some, suddenly to others.

It will produce a better work environment eventually. "There are going to be three basic changes involving the factory worker," said James L. Ridings, P.E., manager, Staunton Operations, McQuay-Perfex Inc., Staunton, Va. in a presentation at the Autofact 4 Conference.

"The first change will be fewer work-

Automation is perceived as a heartless monster bent on the destruction of the unskilled worker.

ers in the factory, fewer people assembling parts, fewer people doing the individual processes. Second, the need for the people in the factory is going to switch from one of performing work to one of providing the maintenance and upkeep of the systems and machines that are actually doing the work.

"Finally, the education level of entry level workers has increased to a point where they are dissatisfied with the normal labor of factory jobs," Mr. Ridings continued.

Getting to the future factory may not be smooth. Fear, resistance, and ignorance will cause early stumbling blocks. Training and retraining can reduce these problems dramatically though. In cases where workers have been involved in the introduction of automation and have had time to learn the advantages of automation, see how it works and see how their jobs fit into the new scheme of things, the transition to automation has been smooth.

Thomas G. Gunn, manager of the Computer Integrated Manufacturing (CIM) Group of Arthur D. Little, Inc. believes that training workers whose skills have become obsolete to accept and use the equipment is so important that educational programs will have to rank as a top priority over the next decade.

He predicts that in ten years nearly all manufacturing employees—from shop floor to top management—will be spending roughly one day in five in seminars and training programs to keep pace with new technology.

The opportunities automation offers are many—a better standard of living, a stronger competitive position in world markets, and better jobs. The problems that stand in the way must be overcome. There is no alternative.

Conversion to the factory of the future is a slow, arduous process measured against world time, but not against an individual's clock.

The widespread use of factory automation will have a significant impact on the social milieu of all industrialized nations. One of the most formidable challenges created by factory automation is the task of retraining labor and restructuring jobs to comply with automated production, according to a recent market study by Venture Development Corp., Wellesley, Mass.

"This is particularly true for industrial robots which, because of their similarity to human motions, raise the spectre of a society dominated by machines and a ruling elite. Already the mass media have coined the name 'steel collar workers' for robots and frequently carry reports about their increasing use," says the study. "For the large number of blue collar workers affected by the current economic downturn and high unemployment, such reports are bound to generate concern."

The Japanese have had tremendous success in the introduction of new technology in the workplace. Some insights into how they have accomplished this, which might aid U.S. companies, are described by Dr. James O'Toole, professor of management, University of Southern California.

"First of all, they offer job security; people are not afraid they will lose their jobs when the new technology is introduced. Second, they start with a relatively well educated work force. Their people have learned how to learn. Assembly line workers will be trained to install or monitor or to repair the new technology; the workers know they will be trained for the new jobs.

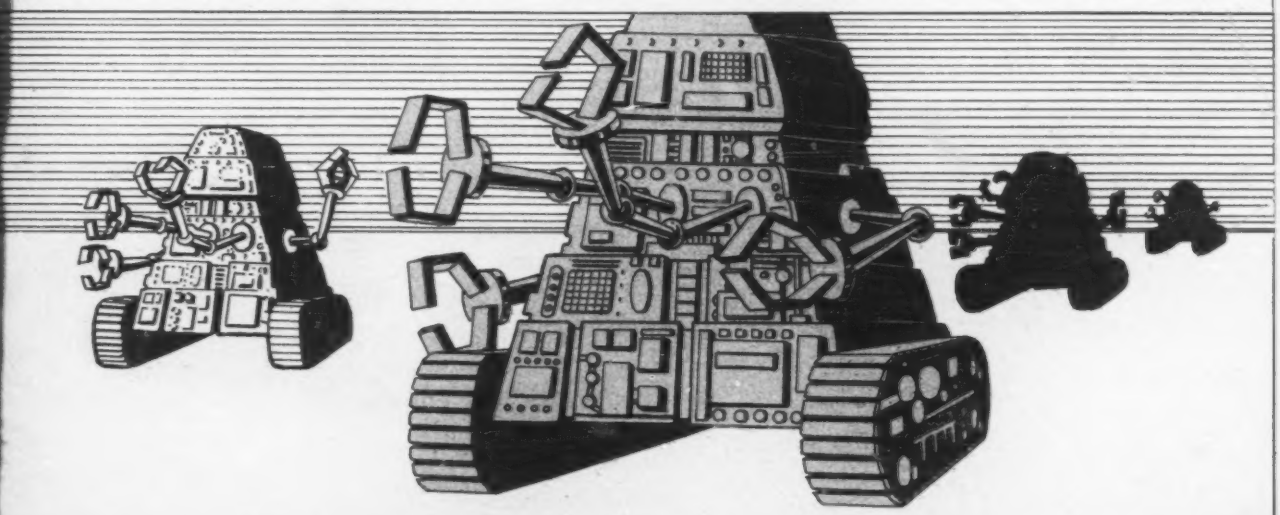
"The third fact is that a major effort is made beforehand to explain to everybody why the new technology is necessary," says Dr. O'Toole.

"The American system is just the opposite of all those things. Someone somewhere makes the decision to automate. The worker suddenly sees a machine coming through the door and feels, 'One, I'm incapable of doing this job; I've never touched a computer in my life. Two, I'm going to lose my job.' Often times he's right on both counts."

The switch to automation is not just a spectre for the blue collar worker. The public opinion study undertaken by Opinion Research shows that there is widespread anticipation that, by the end of the century, both white-collar and blue-collar jobs will be affected to about the same extent.

Moreover, almost two-thirds of the public believe that a great many, if not all, workers will have to learn new skills if automation of the U.S. workplace is significantly increased, according to Mr. Schwartz.

And, despite some of the optimistic conclusions of the study mentioned earlier, Americans have serious misgivings about job security in the face of increased automation. "Nine people in



ten anticipate that employees would be afraid of losing their jobs as a result of automation. In fact, a majority of people believe that, even in the long run, job opportunities in the country would be reduced," says Mr. Schwartz.

Apprehension about loss of job status, too, is generally viewed by the public as likely to occur among employees who face stepped up automation. And more than eight people in ten expect that employees would fear the problems they might encounter in learning new skills. Yet another negative result of increased automation, foreseen by both blue-collar and white-collar employees, is increased pressure on the job.

People in all occupation groups rate opportunities for advancement a toss-up; relatively few expect workers to have more freedom to decide how to do the job.

However, when people consider the possible effects of increased automation on the kind of job they know most about, they anticipate only one positive development, according to the ORC study. No matter what their occupation, people are inclined to agree jobs would be interesting and challenging.

"Almost two-thirds of Americans say that they would resist automation at least a fair amount if it were to increase significantly at a company where they or someone in their family works.

"Women are far more likely than men to oppose such a change, and nonwhites are considerably more negative to the idea than whites. The older people are and the lower their educational level, the more unwilling they are to accept increased automation in the workplace," according to ORC findings.

All in all, comments Mr. Schwartz, "It seems evident that the rapid advance in automation may present the business community with one of the most serious challenges of the century."

What is needed is some way to calm the fears of workers and lead them as gradually as possible into the more interesting and challenging jobs that lie ahead.

There are several factors which complicate a smooth transition.

First, the dismal economic picture of the last year or so has already created so much unemployment and so much fear and resentment on the part of so many, that the effects of automation seem just one more burden on the backs of the working people, a sort of 'last straw.'

Second, the adversarial relationship of unions and management has created a backdrop of distrust that has been around so long, it is hard for either group to really accept a willingness to work together on this issue.

Then, too, most of the technological advances stem somehow from the power of the computer. For many of the older workforce—and in this context older can be 35—the computer is still a foreign object, cloaked in mystery. "Most 9th grade students have a better understanding of computers than many adults," says Adage's Mr. Spann.

"The concept of a formal algorithm is foreign to most people. They do not understand the logical process of telling a computer what to do. It is a very basic change in thought, in conceptualizing, to think of a process as broken down into a series of primitive steps with the computer doing nothing but executing or interpreting each one of these steps or instructions," adds Mr. Spann.

"We see too many people totally perplexed by what is going on and all the adult education and all the public television and everything else is not going to strike this home. We are literally going to wait half a generation until the people who are currently being taught these concepts move into industry," he says.

None of this will impede the onslaught of automation, but it is going to impede making everyone's understanding and acceptance of it crystal clear.

"People are going to be force fed," says Mr. Spann. And not just shop level people.

Mr. Spann gives an example of the kind of shock that is in store for many. "There will be an inventory control manager who used to worry about next week's parts being told by the computer that given the current order lead times, he is already out of parts for April of next year. Whereas, before automation, the manager would wait eleven months to find out.

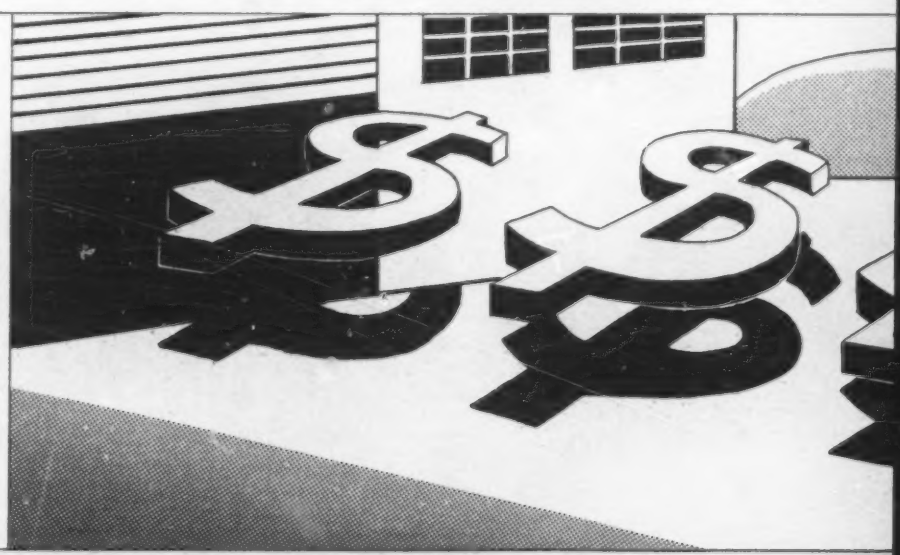
"And this is just primitive automation. When material gets rejected 20 steps before it is being used because the computer knows it won't fit, people are going to react in a predictable fashion," he continues.

When craftsmen made individual products, they had a pride in their work, a direct pride in the product of their craft. Already our industrial society has diminished individual pride by making products that represent the work of many people. And it shows.

If we take this a step further and introduce computer-assisted equipment between the worker and his job function, pride of workmanship takes another beating.

This is one of many problems which

The race to the automated factory pays off in economic growth, better and more competitive products and a higher standard of living for all.



must be overcome. Workers, at all levels, must feel secure in their jobs, they must develop an appreciation for the economic advantages of automation and learn to use it effectively without fear or resentment. And, American industry must be willing to acknowledge that craftsmanship can be found in the synergistic combination of human and computer.

Implementation of factory automation requires many years of co-existence and co-operation between man and machines.

Can today's workforce meet the challenge of tomorrow's factory? "This is the most difficult question that industrial managers are going to have to face as they introduce new technology throughout the rest of the decade," says Dr. O'Toole.

"Right now the assumption on the part of many managers seems to be, 'The people who are production workers are a bunch of dummies. They can't deal with these new technologies. We'll fire them and hire their kids who have been to college or have had some experience with these new technologies in their high schools.' "

Naturally, there is resistance to this idea from unions and workers. But the only way people who are displaced can be retrained is if there is commitment on the part of unions to bargain for it, if managers see the value of retraining and if they have the tools to do it effectively.

At General Motors, for example, the company has taken the Plato system developed by Control Data Corp. and used it to teach former assembly line workers to be robot operators. GM has taught workers how to install, repair, maintain and monitor the new technologies that are being introduced, says Dr. O'Toole.

"What this example shows is that a great number of people with relatively little education can learn if they have access to these training methods that are very much individualized, in which a person can go at his or her own pace."

More manufacturers must introduce major retraining programs. And, existing jobs will have to be restructured with the intention of creating an atmosphere of co-existence between man and machine, according to results of the Venture Development study.

"Without retraining and job restructuring to enable labor to move to supervisory and machine-operating roles, the risk of worker alienation is high. Such alienation would not nurture factory automation, whose implementation is both evolutionary and lengthy, requiring many years of co-existence between workers and machines," says the report.

Beyond the technical training required to help workers adjust to new technology is the personnel training to help people adjust to each other in the changed work environment.

The introduction of new technology changes the social environment that existed. It changes the way people relate to each other and to the organization.

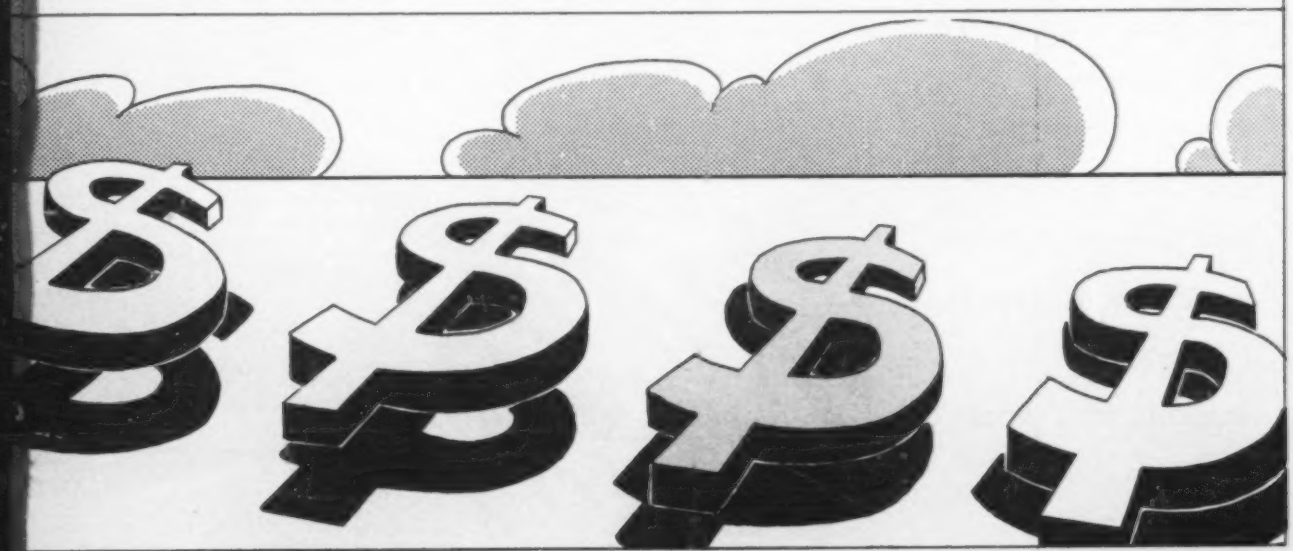
The philosphy grew up in the late 1940s, according to Dr. O'Toole that when you introduce technological change, you should also introduce compatible social change in the organization or else you don't get the full benefit of the technology. It might, indeed, turn out to be counterproductive if it so distorts the social relationships as to make the whole system less productive."

In many cases, a worker now will have access to a computer terminal. That terminal gives him or her access to a lot of information, more than he had before the automated device was installed. The information, which once was the purview of the supervisor is now available to the shop floor worker. What does that do to his relationship to the supervisor who once was important because of the information he possessed?

Well, for sure, it changes the relationships. And it takes a lot of retraining for both worker and supervisor in this new situation.

As Vernon Estes, manager, Robot Applications for General Electric Co. says, "The supervisor in tomorrow's factories will have to motivate rather than dictate. There's no room for Steinbrenners here." As to managing the managers under increased automation, these people must be given a free reign and minimal direction, adds Mr. Estes.

All this is quite a change from what had existed. Workers and foremen meet in a whole new relationship, more as partners than before. No longer are there two classes of workers—those who think and those who do. This new workplace may be harder for the foreman to adjust to than the workers.



The new foreman must be more diverse, says Mr. Estes. He must function as a consultant to the worker to show him what to expect from new equipment. The new foreman is freed of the thankless task of searching out materials and tools. These things are available automatically.

"What we really need is manufacturing engineering type talent," says Mr. Estes. This isn't always available from an academic background. But often is available from people who have worked in factories for a long time. We can take that talent, those people and retrain them, adds the GE executive.

"And, don't knock the older employees," comments Mr. Estes. "Some of them are our best technologists these days. Some of them have less fear of change than the young people coming along. I don't think acceptance of technology relates to age as much as it does to motivation."

There is something to be said for the young however. Through no particular merit of theirs, the younger generation have grown up expecting computers to do the things older people were surprised to see. They are just more comfortable with this type technology and theirs will be the generation that will move that technology from the minimal acceptance it has today to total acceptance in the future.

The third industrial revolution, as some call it, will be controlled by computers, servo mechanisms, adaptive controls, says Mr. Estes.

Training will help the current workforce be a part of that revolution. "It is not an impossible thing to deal with. I can take a good auto mechanic or a good farm boy and make him a good field service man. It takes common sense, enthusiasm and a willingness to work. These fundamentals don't change," adds Mr. Estes.

One plant, the Bingham-Willamette Co. in Portland, Ore. and Shreveport, La. has recently entered the computer age. Workers are using computer terminals located right on the shop floor to enter their daily time and attendance data as well as details about the jobs they perform.

"Although employees have minimal interaction with the terminals, they must understand the reason the system is here and how it works for their benefit as well as that of the company," says Don Price, B-W's plant manager.

"Management, supervisors and union employee representatives were trained to use the system initially and three workstation groups were selected at 'test' sites," says Mr. Price.

Mr. Price says that the production employees have responded positively to the new system. "The main thing that matters to them is the standards by which they are judged. We have not changed those standards, if anything, they've become more objective with an automated system."

Many of the workers also like working around computers. It took them time to adjust to the terminals, but now they feel proud to be associated with advanced technology, which helps bring more esteem to their work. They also appreciate the security of the system, knowing that no one else can tamper with their labor reporting data.

Every employee who uses the system receives a fold-out card that explains how the terminals operate and steps through the procedure to be followed for each of the ten time reporting transactions. In addition, a comprehensive users manual is located near every terminal and quick-reference posters hang on the walls nearby.

One of the system's many reports summarizes employee transactions for the week; it helps call attention to excessive error transactions.

"Supervisors review the report and spend extra time with those workers who are having problems," says Mr. Price. "So far in Portland, the error rate has been quite low, ranging between one and three percent.

Clearly, retraining can be effective. Success depends in large part on the commitment of the company.

This industrial revolution will be controlled by computers, servo mechanisms and adaptive control. Education is the key to success.

Retraining is so much discussed today, it would seem as if there were no progress to report. That is not the case. Initiatives taken so far are ambitious.

Ford and General Motors, in cooperation with the United Auto Workers,

Training takes the fear out of the future and creates a better work environment for both workers and managers.

have launched programs to retrain laid-off workers for new jobs, both in the auto industry and in other growth industries, aerospace and electronics.

These and other active programs were recently reported by the Work in America Institute, Inc.

The Federal Government's new job training act, which relies heavily on private-sector participation to carry-out its goals, has been expanded to include the retraining needs of displaced workers who have little chance of returning to their jobs.

California's Plant Closure Response Unit mobilizes community, labor and company resources in order to develop reemployment programs in the event of plant shutdowns. When General Electric's flat-iron plant closed, electrical assembly-line workers were enrolled in classes to upgrade their skills in electrical assembly and to learn new skills in word processing, according to the Work in America Institute.

And, more and more "business-school partnerships" are emerging in which companies and schools share equipment, facilities and personnel. Student trainees are taught state-of-the-art computer techniques needed for specific job openings, the Institute reports.

Individual companies are also concerned with training and retraining their own people. With all of the changes in business brought about by foreign competition, the introduction of new manufacturing methods such as robotics and office automation, planning for a company's human resources will be a critical factor in determining business success.

Honeywell, Inc., for example, has convened a task force to provide guidance on the issues of office and factory automation.

The task force on factory automation, as part of its study, interviewed 15 major U.S. industrial corporations relative to their policies associated with the use of new manufacturing technology, says Dr. Arnold F. Kanarick, Honeywell's vice president for human resources.

The results of these interviews are interesting. They are:

"Only one company had a 'no-staff reduction' policy relating to increased factory automation.

"Only one company has an active practice of human resource assessment when it comes to authorizing funds for automation equipment.

"Five companies tend to 'protect' office personnel better than factory personnel when it comes to job dislocation.

"Almost all companies state that they expect to 'manage' personnel impacts to a minimum by using normal attrition to balance staff reductions warranted by increased automation.

"Strong hire/fire practices generally parallel union relationships, i.e, management excuses strident practices on the basis of contract obligations.

"No company had a recognized guideline or implementation process for effectively minimizing the human resource impacts of future factory or office automation," according to Dr. Kanarick.

Complete results of the task force work are not yet available, but Honeywell already has several employee training programs operating.

One such, the Modern Technology Concepts program gives selected technical managers and scientists mini-courses on key topics, including solid-state devices, microprocessors, polymers, optical systems and computer graphics. These courses are presented by both University of Minnesota faculty and Honeywell senior scientists. Through this program engineering managers can upgrade their own technical knowledge.

As important, The Honeywell Engineering Management School has been created to sustain personnel effectiveness. This course, also taught by faculty from the University of Minnesota is designed to broaden the people handling capabilities of technical managers.

"Management of stress, coaching, employee counseling, teamwork, listening and career planning are practical skills that mid-career managers need to deal with today's heterogeneous workforce," comments Dr. Kanarick.

Training inside and outside companies is helping to minimize some of the problems the factory of the future concept may create. And to some extent, much has been done already.

Management Science America, (MSA) Inc., Atlanta, Ga., a leading manufacturing software firm, spent 50,000 days of education with its customers last year. These training courses are offered to a range of levels in customer companies.

"We recognize that developing the product is half of our job," says Ray L. Dicasali, vice president of MSA. "We

also have to get it to the customer's environment and we have to educate people, not just a few either. We do a lot of education because there are a lot of people in any company that are going to have to understand what is the problem and what is the solution."

"Manufacturing has been especially attuned to this issue for some years," says Mr. Dicasali.

And, Mr. Dicasali is positive about the future. He feels that over the past several years both managers and staff of customer companies are less intimidated by technology than before.

Individuals in customer companies are more willing to take responsibility for the new technology, and manage the new technology so that it doesn't disrupt the business.

Pete Link of Link and Associates, management consulting firm based in Arlington, Texas, is also optimistic about the future. "Technology will be implemented at a slow enough pace to smooth the transition for most companies. There will be automation introduced, robotics and flexible manufacturing systems, but we won't see an integrated factory for a long time. Today's kids are going to be in the workforce before we get to the factory of the future," he says.

"I heard the same scare talk when numerical control was introduced in the '60s. It hasn't cost jobs. Attrition will take care of most of the problems. And the young people entering the job market will adjust easily to the new environment."

Training is paramount, though, states Mr. Link, and companies are beginning to realize this and initiate training programs.

One interesting theory proposed by Sperry Univac's Mr. Vollum is that factory work had never been considered a glamour job until recently. Now it is attracting the brightest, most capable graduates.

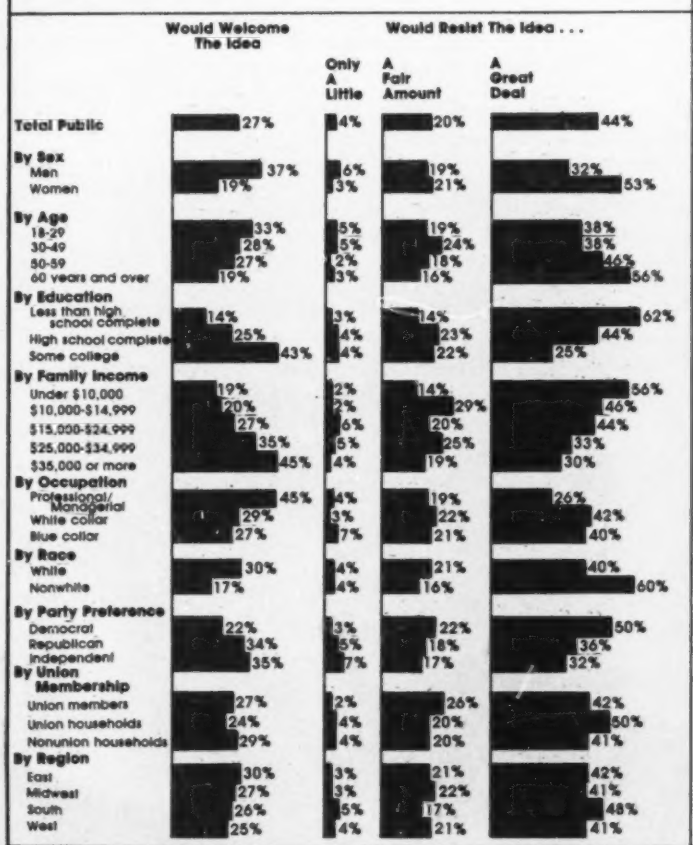
"The level of interest in manufacturing is high; the dedication of the new employees in the factory is going to be high. Factory work is not going to be boring, as it was once characterized."

Shop level workers in the new factory will have to learn how to maintain and run computer-controlled machinery. The skilled apprenticeship programs which trained people for factory work will be supplanted by trade school programs, says Mr. Vollum.

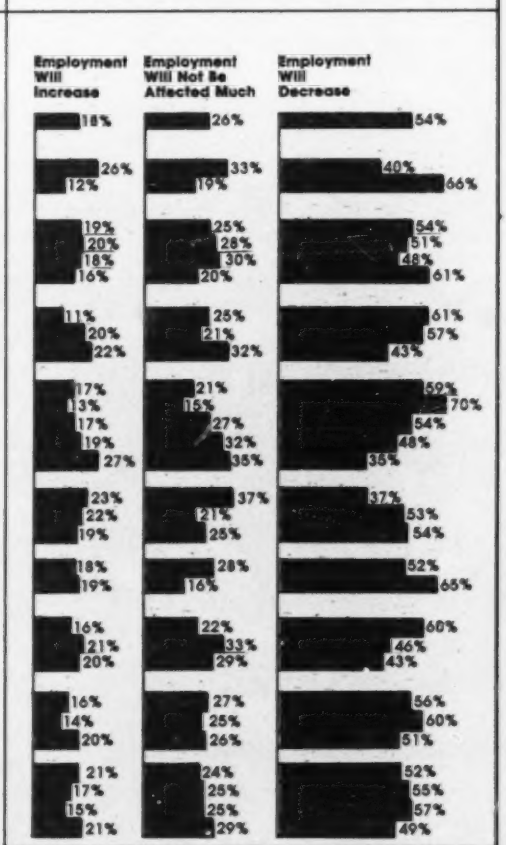
The Sperry Univac executive believes the aerospace and automotive industries will lead in the implementation of automation. (Cont. on p. 56)

Fear and Resistance Mark the Public's View of Automation

Acceptance of a significant increase in the use of robots and automated work procedures

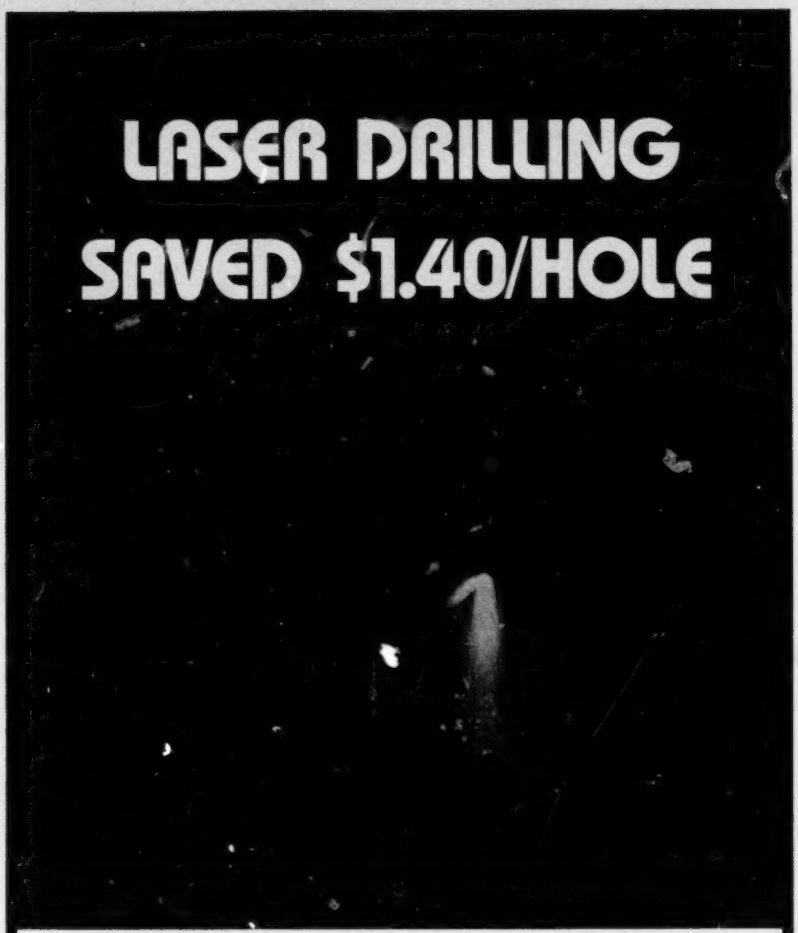

Would Welcome The Idea
Would Resist The Idea . . .
Only A Little
A Fair Amount
A Great Deal
Total Public 27% 4% 20% 44%
By Sex
Men 37% 6% 19% 32%
Women 19% 3% 21% 53%
By Age
18-29 33% 5% 19% 38%
30-49 28% 5% 24% 38%
50-59 27% 2% 18% 46%
60 years and over 19% 3% 16% 56%
By Education
Less than high school complete 14% 3% 14% 62%
High school complete 25% 4% 23% 44%
Some college 43% 4% 22% 25%
By Family Income
Under $10,000 19% 2% 14% 56%
$10,000-$14,999 20% 2% 29% 46%
$15,000-$24,999 27% 6% 20% 44%
$25,000-$34,999 35% 5% 25% 33%
$35,000 or more 45% 4% 19% 30%
By Occupation
Professional/ Managerial 45% 4% 19% 26%
White collar 29% 3% 22% 42%
Blue collar 27% 7% 21% 40%
By Race
White 30% 4% 21% 40%
Nonwhite 17% 4% 16% 60%
By Party Preference
Democrat 22% 3% 22% 50%
Republican 34% 5% 18% 36%
Independent 35% 7% 17% 32%
By Union Membership
Union members 27% 2% 26% 42%
Union households 24% 4% 20% 50%
Nonunion households 29% 4% 20% 41%
By Region
East 30% 3% 21% 42%
Midwest 27% 3% 22% 41%
South 26% 5% 17% 48%
West 25% 4% 21% 41%

Long-term effect on U.S. employment if the use of automation (robots and automated work procedures) increases significantly.


Employment Will Increase
Employment Will Not Be Affected Much
Employment Will Decrease
Total Public 18% 26% 54%
By Sex
Men 26% 33% 40%
Women 12% 19% 66%
By Age
18-29 19% 25% 54%
30-49 20% 28% 51%
50-59 18% 30% 48%
60 years and over 16% 20% 61%
By Education
Less than high school complete 11% 25% 61%
High school complete 20% 21% 57%
Some college 22% 32% 43%
By Family Income
Under $10,000 17% 21% 59%
$10,000-$14,999 13% 15% 70%
$15,000-$24,999 17% 27% 54%
$25,000-$34,999 19% 32% 48%
$35,000 or more 27% 35% 35%
By Occupation
Professional/ Managerial 23% 37% 37%
White collar 22% 21% 53%
Blue collar 19% 25% 54%
By Race
White 18% 28% 52%
Nonwhite 19% 16% 65%
By Party Preference
Democrat 16% 22% 60%
Republican 21% 33% 46%
Independent 20% 29% 43%
By Union Membership
Union members 16% 27% 56%
Union households 14% 25% 60%
Nonunion households 20% 26% 51%
By Region
East 21% 24% 52%
Midwest 17% 28% 55%
South 15% 25% 57%
West 21% 29% 49%

Notes: These statistics are part of the findings of a Public Opinion Survey conducted by Opinion Research Corp., Princeton, N.J. Results are based on telephone interviews with a national probability sample of 1005 persons.
"Don't know" responses omitted.

LASER DRILLING SAVED $1.40/HOLE



What would you say it costs to drill a 0.060-in.-thick diameter lubrication hole through the 0.375-in.-thick wall of an internal gear made of hot-forged, powder-metal 4662 alloy (Rockwell "C" 60)? A major manufacturer reports the answer is $1.50 per hole using conventional techniques. Why so expensive? Because the carbide tipped drills used dulled after six to eight holes and had to be replaced.

By trepanning the hole with a CLC Series 400 Pulsed Nd:YAG Laser, the cost has been reduced to 10¢ per hole — a $1.40 savings! But, what about production rates? The laser technique takes four seconds per hole which, including handling time, converts to 675 holes per hour.

If you want to know more about the laser way, contact the CLC sales office closest to you from the following:

Sunnydale	408/735-7272	St. Paul	612/546-4772	Boston	617/720-4907
Denver	303/761-2934	Detroit	313/576-0450	Newark	201/667-8114
Dallas	214/251-1776	Cincinnati	513/489-6213	Montreal	514/866-2851
Chicago	815/399-2068	Orlando	305/851-2540	Toronto	416/298-8731

CONTROL LASER CORPORATION

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305/851-2540 • TELEX 564407 • WATS 800/327-6036

For Information, Circle 141

METALWORKING'S MANUFACTURING SYSTEMS

It is in the economic interests of these industries to automate. And automation only makes sense if it is economically justified.

The smaller job shops will lag behind for the same reasons.

Mr. Vollum sees automation introduced gradually, but not gradually enough to prevent a terrible shock for a lot of workers.

And Dr. O'Toole believes that "If we don't come up with some very creative ways of retraining the 10 million or so people that are out of work today, we face the most serious challenge to our nation since the depression."

Workers, both union and non-union, who for years have been well paid, even over-paid, and have enjoyed the fruits of the American system, will find technological unemployment intolerable, he says.

These people may turn and undercut that very system and create enormous social problems. □

Metalworking's Manufacturing System: 37

Other articles in this series in 1982:

Training the Next Generation of Manufacturers, Jan. 22, pp. 62-65

Data Communications: Vital Link in a Manufacturing System, Feb. 19, pp. 75-79

Robots Extend a Helping Hand, March 19, pp. 59-63

PCs Provide Shop Floor Control With Boardroom Impact, April 23, pp. 94-98

Speech Technology: The Voice of Tomorrow's Factories? May 21, pp. 92-97

The Emerging Worldwide NC Race, June 25, pp. 59-64

Are Superminis Challenging The Mainframe Computers, July 23, pp. 57-65

Now, It Can Be Tested on The Terminal, Aug. 20, pp. 109-112

Is It Time for a New Approach to NC Programming?, Sept. 24, pp. 83-89

Are Factory Systems the Path to Productivity?, Oct. 22, pp. 41-48

Will Turnkey CAD/CAM Systems Remain Viable?, Nov. 19, pp. 49-56

Guidelines for Buying a Personal Computer, Dec. 15, pp. 49-53

In 1983:

Air Force ICAM Project Paves the Way for the Factory of the Future, Jan. 21, pp. 48-55

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EFFECTIVE FEBRUARY 14, 1983

MATERIALS NEWSFRONT

Important Notice About Iron Age Scrap Prices

Beginning with the Jan. 21 issue Iron Age has been publishing only one set of scrap prices per issue—those with the effective date as close to the issue date as printing schedules permit. Prices for other weeks are available on a weekly basis through our Metal Price Phone Hotline or through our Weekly Price Newsletter.

Steel Production, Composite Prices

(Effective February 14, 1983)

U.S. Steel Production	Last Week	Two Weeks Ago	To Date 1983	To Date 1982
Net tons, in thousands	1,373	1,358	7,851	10,652
Capability Utilization Rate	47.4	46.8	44.1	58.9

Composite Prices	This Week	Week Ago	Month Ago	Year Ago
Finished Steel Base* (¢/lb.—eff. 2/14/83)	26.217	25.954	25.954	25.195
Pig Iron* * (Net ton= 2000 lbs.)	$213.00	$213.00	$213.00	$213.00
Scrap No. 1 hvy.* * * (Gross ton=2240 lbs.)	$ 67.50	$ 67.50	$ 61.50	$ 84.50
No. 2 bundles	$ 47.83	$ 47.83	$ 42.50	$ 56.50
Scrap Comparison (Gross Ton)				
No. 1 steel, Pittsburgh	$ 69.50	$ 69.50	$ 62.50	$ 94.50
No. 1 steel, Philadelphia	61.50	61.50	59.50	75.50
No. 1 steel, Chicago	71.50	71.50	62.50	83.50
No. 1 bundles, Detroit	61.50	61.50	48.50	83.50
Low Phos., Youngstown	69.50	69.50	64.50	95.50
No. 1 mach'y cast., Pgh	66.50	66.50	61.50	93.50
No. 1 mach'y cast., Phila	98.50	98.50	98.50	113.50
No. 1 mach'y cast., Chi	109.50	109.50	106.50	126.50

*Finished Steel Composite
Weighted index of steel bars, shapes, plates, wire, rails, black pipe, hot and cold rolled sheets and strips.

* *Pig Iron Composite
Based on average prices for basic and foundry pig iron at representative producing points within the U.S.

* * *Steel Scrap Composite
Average of No. 1 hvy. melting steel scrap and No. 2 bundles delivered to consumers at Pittsburgh, Philadelphia and Chicago.

Lake Superior Ore Prices

51.50% Fe Natural delivered lower Lake ports. Rail transportation, handling and unloading may be charged to the account of the buyer. Coarse ore 80¢ premium.

Pellets (per iron unit natural)..... gross-ton 80.50-86.9*
Old range, non-bessemer ..... gross-ton $32.78
Mesabi, regular-unscreened ..... gross-ton $32.53
Mesabi, non-bessemer.....gross-ton $32.25-32.53**

*80.50¢—Pickands Mather as of 1/27/81.
**86.9¢—U. S. Steel as of 3/15/82. Cleveland-Cliffs as of 2/26/82, Oglebay Norton as of 3/25/82, and Hanna Mining as of 2/26/82.

Nonferrous Prices

(Effective February 14, 1983)
Prices obtained in trade based on representative tonnages per gross ton delivered to consumer unless otherwise stated.

Primary Metal Prices

(cents per lb.)	current price	last price	date of change
Aluminum	76.00 (Nom.)	76.00-80.00	1/4/82
Copper (C)	79.00-80.00	79.00	2/11/83
Lead	20.50-23.00	21.00-23.00	2/9/83
Magnesium Ingot	134.00	125.00	6/1/81
Nickel	329.00	350.00	11/25/81
Titanium Sponge	555.00-585.00	555.00	4/29/82
Zinc	40.00	38.00-40.00	1/11/83

ALUMINUM: 99.5%. COPPER (C) = cathode. LEAD: common grade. MAGNESIUM: 99.8% pig. Velasco, Tex. NICKEL: electro., Port Colborne, Canada. ZINC: high grade.

Antimony, American Laredo, Texas . $2.00
Beryllium-aluminum 5% Be, per lb. contained Be $201.00
Beryllium-copper, per lb. cont. Be $121.00
Beryllium 97% powder 200 ..... $166.00
Bismuth, ton lots ..... $1.25-$1.40
Cadmium, under one ton ..... $1.05-$1.15
Calcium, ton lots, crown $3.05
Chromium, 99.8% $3.75
Cobalt, 99%, cathode $12.50
Gold per troy oz. $500.50
Indium, dollars per troy oz..... $2.60-$2.85
Iridium, dollars per troy oz..... $600
Magnesium sticks, 10,000 lbs. $1.91
Mercury, per 76-lb. f.o.b. N.Y. ..$335-$360
Molybdenum, lb. tech. moly oxides, 20 lb. MO can $5.85
Nickel oxide sinter at U.S. points of entry $3.12
Palladium, per troy oz. $140
Platinum, per troy oz. $475
Rhodium, per troy oz. $600.00
Silver ingots, per troy oz..... $14.53
Vanadium $4.94
Zirconium sponge..... $12.00-$17.00
(Per lb. unless otherwise noted)

Straits Tin Price

(U.S. cents per lb, EX-SMELTER, based on daily market in Penang in Malaysian dollars per kilo.)

Feb. 7—577.55 Feb. 10—584.04
Feb. 8—579.67 Feb. 11—588.64
Feb. 9—581.52

Scrap Prices

Brass Mill Scrap

(Cents per lb; over 20,000 lbs. add 1¢ per lb)

	Solids	Turning
Copper	75½	66¼
Yellow brass	64¼	59⅛
Red brass	69½	62⅝
Comm. bronze	71	64
Mang. bronze	62¾	61
Free cutting rod ends	52	51

Custom Smelters Scrap

(Cents per lb., carload lots, del. refinery)

No. 1 copper wire	67
No. 2 copper wire	59
Light copper	50

Ingot Makers Scrap

(Cents per lb., carload lots, del. refinery)

No. 1 copper wire	63
No. 2 copper wire	55
Light copper	46
No. 1 composition	51
No. 1 comp. turnings	48
Hvy. yellow brass solids	35
Hvy. yellow brass turnings	26
Radiators	42

Aluminum

New mixed clips	29	—30
Old sheet	27	—28
Old cast	27	—28
Clean dry borings	28	—29

Dealers' Scrap

(Dealers' buying price f.o.b. New York in cents per pound)

Aluminum

Segregated clippings	25	—26
Mixed L.C. clips	22	—23
Old sheets and cast	17	—18
Borings and turnings	11	—12
Duraluminum clippings	22	—23

Copper and Brass

No. 1 copper wire	53	—54
No. 2 copper wire	46	—47
Light copper	41	—42
Radiators	35	—36
No. 1 composition	42	—43
No. 1 composition turn'gs	40	—41
Cocks and faucets	31	—32
Clean heavy yellow brass	29	—30
Brass Pipe	29	—30
New soft brass clippings	40	—41

Lead

Heavy soft lead	10	—11
Whole batteries	4	— 5
Type metal	15	—16
Electrotype	17	—18

Nickel

Nickel solids	95	—100
Nickel rod ends	95	—100
Nickel sheets, clips	95	—100
Nickel turnings	45	— 50

Zinc

New zinc clippings	15	—16
Old diecast zinc	9	—10

EFFECTIVE FEBRUARY 14, 1983

MATERIALS NEWSFRONT

(Effective February 14, 1983) Prices obtained in trade based on representative tonnages per gross ton delivered to consumer unless otherwise stated. Prices are the opinions of *Iron Age* editors and correspondents, based on contacts with dealers, brokers, generators and users in the industry on the effective date listed above.

Ferrous Scrap Prices

Pittsburgh

No. 1 hvy. melting	$ 69.00 to	$ 70.00
No. 2 hvy. melting	59.00 to	60.00
No. 1 dealer bundles	84.00 to	85.00
No. 1 factory bundles (auto)	83.00 to	84.00
No. 2 bundles	49.00 to	50.00
No. 1 busheling	79.00 to	80.00
Machine shop turn.	6.00 to	7.00
Shoveling turnings	20.00 to	21.00
Cast iron borings	18.00 to	19.00
Low phos. punchings plate	84.00 to	85.00
Heavy turnings	59.00 to	60.00
No. 1 RR hvy. melting	76.00 to	77.00
Rails 2 ft. and under	85.00 to	86.00
Scrap rails, random lgth	80.50 to	81.50
RR specialties	78.00 to	79.00
No. 1 machinery cast	66.00 to	67.00
Cupola cast	59.00 to	60.00
Heavy breakable cast	30.00 to	31.00
Stainless		
18-8 bundles and solids	465.00 to	475.00
18-8 turnings	365.00 to	375.00

Chicago

No. 1 hvy. melting	$ 71.00 to	$ 72.00
No. 2 hvy. melting	62.00 to	63.00
No. 1 dealer bundles	79.00 to	80.00
No. 1 factory bundles (auto)	79.00 to	80.00
No. 2 dealer bundles	49.00 to	50.00
No. 1 busheling	78.00 to	79.00
Shredder scrap	78.00 to	79.00
Machine shop turn.	14.00 to	15.00
Mixed bor. and turn.	15.00 to	16.00
Shoveling turnings	19.00 to	20.00
Cast iron borings	36.00 to	37.00
Low phos. forge crop	87.00 to	88.00
Low phos. punchings plate ¼ in. and heavier	92.00 to	93.00
Low phos. 2 ft. and under	87.00 to	88.00
No. 1 RR hvy. melting	77.00 to	78.00
Scrap rails, random lgth	69.00 to	70.00
Reroller rails	95.00 to	96.00
Rails, 2 ft. and under	89.00 to	90.00
RR couplers and knuckles	79.00 to	80.00
RR car axles	104.00 to	105.00
No. 1 machinery cast	109.00 to	110.00
Cupola cast	94.00 to	95.00
Stove plate	88.00 to	89.00
Steel car wheels	79.00 to	80.00
Stainless		
18-8 bundles and solids	420.00 to	430.00
18-8 turnings	320.00 to	330.00
430 bundles and solids	95.00 to	100.00
430 turnings	70.00 to	75.00

Philadelphia

No. 1 hvy. melting	$ 60.00 to	$ 63.00
No. 2 hvy. melting	52.00 to	55.00
No. 1 dealer bundles	74.00 to	77.00
No. 2 dealer bundles	43.00 to	46.00
No. 1 busheling	74.00 to	77.00
Shredder scrap	72.00 to	75.00
Machine shop turn.	20.00 to	23.00
Mixed bor. and turn.	20.00 to	23.00
Shoveling turnings	35.00 to	38.00
Low phos. 5 ft. and under	72.00 to	75.00
Low phos. 2 ft. punchings	87.00 to	90.00
Electric furnace bundles	86.00 to	89.00
RR specialties	76.00 to	79.00
Rails, 2 ft. and under	89.00 to	92.00
Cupola cast	56.00 to	59.00
Heavy breakable cast	53.00 to	56.00
No. 1 machinery cast	97.00 to	100.00

Detroit

Broker buying prices per gross ton on cars:

No. 1 hvy. melting	$ 48.00 to	$ 49.00
No. 2 hvy. melting	46.00 to	47.00
No. 1 dealer bundles	61.00 to	62.00
No. 2 bundles	27.00 to	28.00
No. 1 busheling	60.00 to	61.00
Drop forge flashings	37.00 to	38.00
Machine shop turn.	22.00 to	23.00
Mixed borings and turn.	11.00 to	12.00
Shoveling turnings	22.00 to	23.00
Cast iron borings	10.00 to	11.00
Heavy breakable cast	29.00 to	30.00
Mixed cupola cast	45.00 to	46.00
Automobile cast	65.00 to	66.00
Stainless		
18-8 bundles and solids	355.00 to	365.00
18-8 turnings	235.00 to	245.00
430 bundles and solids	85.00 to	95.00

Youngstown

No. 1 hvy. melting	$ 64.00 to	$ 65.00
No. 2 hvy. melting	59.00 to	60.00
No. 1 dealer bundles	76.00 to	77.00
No. 2 dealer bundles	39.00 to	40.00
Machine shop turn.	2.00 to	3.00
Shoveling turnings	7.00 to	8.00
Low phos. plate	69.00 to	70.00
Electric furnace bundles	75.00 to	76.00
Galvanized bundles	65.00 to	66.00

Cleveland

No. 1 hvy. melting	$ 67.00 to	$ 68.00
No. 2 hvy. melting	29.00 to	30.00
No. 1 dealer bundles	72.00 to	73.00
No. 1 factory bundles	81.00 to	82.00
No. 2 bundles	24.00 to	25.00
No. 1 busheling	72.00 to	73.00
Machine shop turn.	2.00 to	3.00
Mixed bor. and turn.	2.00 to	3.00
Shoveling turnings	5.00 to	6.00
Cast iron borings	5.00 to	6.00
Cut structural & plates, 2 ft. and under	95.00 to	96.00
Low phos. punchings plate	95.00 to	96.00
Drop forge flashings	33.00 to	34.00
Foundry steel, 2 ft. & under	59.00 to	60.00
No. 1 RR hvy melting	63.00 to	64.00
Rails, 2 ft. and under	99.00 to	100.00
Rails, 18 in. and under	100.00 to	101.00
Steel axle turnings	69.00 to	70.00
Railroad cast	82.00 to	83.00
No. 1 machinery cast	89.00 to	90.00
Cupola cast	62.00 to	63.00
Stove plate	47.00 to	48.00
Stainless		
18-8 bundles	275.00 to	285.00
18-8 turnings	225.00 to	235.00
430 bundles	75.00 to	85.00

Buffalo

No. 1 hvy. melting	$ 27.00 to	$ 28.00
No. 2 hvy. melting	17.00 to	18.00
No. 1 busheling	32.00 to	33.00
No. 1 dealer bundles	30.00 to	31.00
No. 2 bundles	14.00 to	15.00
Machine shop turn.	3.00 to	4.00
Mixed bor. and turn.	10.00 to	11.00
Shoveling turnings	12.00 to	13.00
Cast iron borings	9.00 to	10.00
Low phos. plate	50.00 to	51.00
Structural and plate, 2 ft. and under	48.00 to	49.00
Rails, 2 ft. and under	44.00 to	45.00
Scrap rails, random lgth	24.00 to	25.00
No. 1 machinery cast	65.00 to	66.00
No. 1 cupola cast	42.00 to	43.00

St. Louis

No. 1 hvy. melting	$ 58.00 to	$ 59.00
No. 2 hvy. melting	50.00 to	51.00
Foundry steel, 2 ft.	50.00 to	51.00
No. 1 dealer bundles	58.00 to	59.00
No. 2 bundles	47.00 to	48.00
Machine shop turn.	12.00 to	13.00
Shoveling turnings	18.00 to	19.00
Cast iron borings	30.00 to	31.00
No. 1 RR hvy. melting	58.00 to	59.00
Rails, random length	49.00 to	50.00
Rails, 18 in. and under	64.00 to	65.00
RR specialties	80.00 to	81.00
Cupola cast	70.00 to	71.00
Heavy breakable cast	48.00 to	49.00
Stove plate	70.00 to	71.00
Cast iron car wheels	49.00 to	50.00
Rerolling rails	84.00 to	85.00
Unstripped motor blocks	55.00 to	56.00

Birmingham

No. 1 heavy melting	$ 56.00 to	$ 57.00
No. 2 heavy melting	52.00 to	53.00
No. 1 dealer bundles	56.00 to	57.00
No. 2 bundles	40.00 to	41.00
No. 1 busheling	54.00 to	55.00
Shredder scrap	71.00 to	72.00
Machine shop. turn.	18.00 to	19.00
Shoveling turnings	25.00 to	26.00
Cast iron borings	26.00 to	27.00
Electric furnace bundles	53.00 to	54.00
Elec. furnace, 3 ft. & under	50.00 to	51.00
Structural and plate, 2 ft.	70.00 to	71.00
Structural and plate, 4 ft.	69.00 to	70.00
No. 1 RR hvy. melting	55.00 to	56.00
Scrap rails, random lgth	57.00 to	58.00
Rails, 18 in. and under	74.00 to	75.00
Angles and splice bars	67.00 to	68.00
No. 1 cupola cast	74.00 to	75.00
Unstripped motor blocks	52.00 to	53.00

Cincinnati

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 46.00 to	$ 47.00
No. 2 hvy. melting	45.00 to	46.00
No. 1 dealer bundles	47.00 to	48.00
No. 2 bundles	26.00 to	27.00
Machine shop turn.	4.00 to	5.00
Shoveling turnings	7.00 to	8.00
Cast iron borings	8.00 to	9.00
Low phos. 18 in. and under	73.00 to	74.00
Rails, random length	55.00 to	56.00
Rails, 2 ft. and under	77.00 to	78.00
No. 1 cupola cast	60.00 to	61.00
Heavy breakable cast	24.00 to	25.00
Drop broken cast	64.00 to	65.00

New York

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 29.00 to	$ 30.00
No. 2 hvy. melting	25.00 to	27.00
No. 2 dealer bundles	22.00 to	23.00
Mixed bor. and turn.	7.00 to	8.00
Machine shop turn.	4.00 to	5.00
Shoveling turnings	10.00 to	12.00
Clean cast. chem. borings	34.00 to	35.00
No. 1 machinery cast	89.00 to	90.00
Mixed yard cast	38.00 to	39.00
Heavy breakable cast	14.00 to	15.00
Stainless		
18-8 prepared solids	385.00 to	410.00
18-8 turnings	280.00 to	300.00
430 prepared solids	70.00 to	80.00
[illegible]	60.00 to	70.00

[illegible]ton

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 32.00 to	$ 34.00
No. 2 hvy. melting	23.00 to	25.00
No. 1 dealer bundles	37.00 to	39.00
No. 2 bundles	20.00 to	22.00
No. 1 busheling	37.00 to	39.00
Shredder scrap	38.00 to	40.00
Machine shop turn.	1.00 to	2.00
Shoveling turnings	1.00 to	2.00
No. 1 machinery cast	105.00 to	110.00
Mixed cupola cast	23.00 to	25.00
Heavy breakable cast	4.00 to	6.00

San Francisco

No. 1 hvy. melting	$ 39.00 to	$ 41.00
No. 2 hvy. melting	31.00 to	33.00
No. 1 dealer bundles	26.00 to	28.00
No. 2 dealer bundles	11.00 to	13.00
Machine shop turn.	4.00 to	6.00
Cast iron borings	4.00 to	6.00
No. 1 cupola cast	83.00 to	85.00

Los Angeles

No. 1 hvy. melting	$ 38.00 to	$ 40.00
No. 2 hvy. melting	27.00 to	29.00
No. 1 dealer bundles	25.00 to	27.00
No. 2 dealer bundles	8.00 to	10.00
Machine shop turn.	4.00 to	6.00
Shoveling turnings	8.00 to	10.00
Cast iron borings	4.00 to	6.00
Elec. furnace, 1 ft. and under (foundry)	84.00 to	86.00
No. 1 cupola cast	86.00 to	88.00

Seattle

No. 1 hvy. melting	$ 55.00 to	$ 57.00
No. 2 hvy. melting	44.00 to	46.00
No. 2 bundles	33.00 to	35.00
No. 1 cupola cast	90.00 to	92.00
Mixed yard cast	78.00 to	80.00

Hamilton, Ont.

Brokers buying price per net ton on cars:

No. 1 heavy melting	$ 38.00
No. 2 heavy melting cut 2 ft. and under	35.00
No. 1 dealer bundles	45.00
No. 2 bundles	5.00
Mixed steel scrap	22.00
Bush. new fact. prep'd.	43.00
Bush. new fact. unprp'd.	35.00
Machine shop turn.	20.00
Short steel turn.	23.00
Mixed bor. and turn.	12.00
Cast scrap	35.00

Houston

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 52.00 to	$ 53.00
No. 2 hvy. melting	40.00 to	41.00
No. 2 bundles	28.00 to	30.00
Machine shop turn.	12.00 to	13.00
Crushed turnings	24.00 to	26.00
Shredder scrap	52.00 to	53.00
Cut structural plate 2 ft. and under	74.00 to	76.00
Unstripped motor blocks	55.00 to	57.00
Cupola cast	64.00 to	66.00

METALWORKING ORDER TRENDS

Now, price cooling threatens to turn into deflation

Disinflation was the name of the game in producer prices through much of 1981 and all of 1982.

As 1983 opened, the game had a new name: Deflation.

Prices of producer finished goods in January dropped 1.0 pct from the last month of 1982. The keeper of the price keys, the U.S. Labor Dept., noted that the January decrease was the steepest since its price index was first calculated in 1947.

Running right along with the downward price move in finished goods, were declines in tags on both intermediate goods and crude materials. The price route was a broad-based one.

Prices of metalworking goods didn't actually deflate in January, but they were close to the zero-change point. The average January price advance for the 22 key metalworking product lines listed on the table here came to 0.1 pct. If held for a year, that monthly average would result in an annual price rise rate of 1.2 pct.

Prices of capital equipment in January were down from December by 0.1 pct.

This was the third time over the 12-month period ending in January that capital equipment prices deflated.

January's strongest downward price push wasn't in metalworking. At the center of the deflation whirlpool was a 4.2 pct fall in energy prices.

This was also where the big price turnaround occurred. In contrast to the January 4.2 pct drop, energy prices had climbed an average 2 pct a month during the six months ended in November of last year.

The current squeeze on prices, of course, comes from recession-hit market demand that has turned the U.S. industrial landscape into a virtual wasteland of idle plants. As one metalworking executive explains, companies make price concessions on their products "to make some sales and get some money in to pay the heating and lighting bills at their plants."

Things may not be that desperate, the general idea seems to be on target.

Tags on metalworking goods aren't yet stamped 'deflationary,' but many are getting close to that point. But deflation doesn't seem likely at hand—at least, not on any sustained basis. That's because budding signs of recovery in the consumer sector foreshadows stronger market demand soon for industrial goods lines.

Latest Month Covered: January, 1983

Products	Index Reading For Month (1967 = 100)	Pct Change From Previous Month	Pct Change From Year-Ago Month
Metal Cutting Machine Tools	373.8	+ 0.3	+ 3.5
Metal Forming Machine Tools	413.1	+ 0.3	+ 4.5
Agricultural Machinery & Equip.	321.4	+ 0.5	+ 6.0
Construction Machinery & Equip.	348.6	+ 0.2	+ 3.4
Industrial Process Furnace & Ovens	357.0	+ 0.2	+ 4.6
Industrial Material Handling Equip.	286.6	− 0.1	0
Pumps, Compressors & Allied Equip.	349.6	+ 0.4	+ 2.3
Fluid Power Equip. (Dec. 1970 = 100)	248.9	0	+ 4.9
Mechanical Power Transmission Equip.	312.9	+ 0.3	+ 1.3
Automobiles	218.8	0	+ 1.6
Motor Trucks—Light	275.3	0	+ 1.3
Motor Trucks—Heavy	317.5	0	+ 6.8
Railroad Equipment	357.6	0	+ 3.4
Fabricated Metal Structural Products	303.3	− 0.4	0
Electric Motors	298.8	0	+ 2.6
Valves (Metal, Ex-Fluid Power—Dec. 1982=100)	100.3	+ 0.3	NA
Ball & Roller Bearings	330.9	− 1.3	+ 2.8
Cutting Tools & Accessories	272.2	0	+ 2.7
Heating Equipment	240.1	+ 0.3	+ 2.9
Plumbing Fixtures & Brass Fittings	280.6	+ 0.5	+ 2.2
Metal Containers	327.0	+ 0.4	+ 0.8
Miscellaneous Metal Products	288.6	0	+ 2.6

Data based on U.S. Labor Dept.'s Producer Price Index